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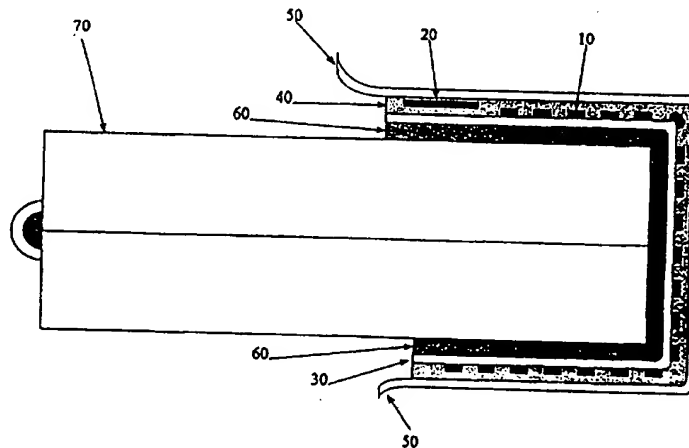
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(54) Title: A CONFORMABLE INTELLIGENT TAG



(57) Abstract

The object of the present invention is to provide a novel system and method, employing an electronically interrogated conformable tag, for the preservation of authenticity of a number of articles containing for example music records, audio and visual cassettes, compact disks, mini disks, CD-ROM's, VCD's, boxes containing cigars, spirits, perfumes, etc., the tag being glued across the sealing edges of these articles. It is another object of the present invention to provide an electronically interrogated conformable tag that may be permanently damaged upon any attempt of its removal by peeling, detaching or cutting, in a system and method for detecting the unauthorised opening of packages. It is a further object of the present invention to provide an electronically interrogated conformable tag that may contain information related to the contents of the package in a system and method for detecting the unauthorised opening of packages.

A CONFORMABLE INTELLIGENT TAG

A conformable and intelligent tag is used in a system and method for detecting the unauthorised opening of packages that have a distinct way of opening.

5 The intelligent tag, being conformable, may be used for the preservation of authenticity of a number of articles for example music records, audio and visual cassettes, compact disks, mini disks, CD-ROM's, VCD's, boxes containing cigars, spirits, perfumes, etc., the tag being glued across the sealing edges and following the contour of these articles.

10 The intelligent tag may have embedded an appropriate electronic circuitry that therein may be interrogated by a transmitting and receiving unit either by ensuring ohmic contact with the appropriate pads provided on the surface of the intelligent tag or from a relatively short distance in a wireless manner. The electronic circuit is necessary for storing a number of data related to the producer of the goods, the contents of the package and any other information relevant to the nature of the contents. For example, in the case of musical compact disks information is required to be stored related to the so-called "label copy", i.e. catalogue number and ID of producing company, date of release, the most famous composer involved, etc.

20 The intelligent tag with its electronic circuitry may be adhered to the appropriate position of the package to be protected so that any attempt to remove it either by cutting or peeling will induce a permanent damage of the embedded electronic circuitry. A transmitting and receiving unit may detect the operating condition of the circuitry and subsequently the information stored in its memory by providing an appropriate interrogation protocol after the external powering of the embedded circuitry either by electrical contact or by a radio frequency emission. Thus, the novel method is based on an electronically and visually detectable conformable intelligent tag.

25 The present invention relates to a system and method for sealing packages and securing the authenticity of the contents of the package. More particularly the present invention relates to a system and method for electronically and visually detecting the opening of

the package and thus preventing the frauding of the contents by sticking a conformable intelligent tag on the appropriate sealing edge(s) of the packages so that to have a permanent damage induced to the incorporated electronic circuit upon removal of the tag.

5 Frauding detection technology, as it has been applied to the sealing of such items, has usually included an indicator tag in the form of printed paper and/or laminated structure containing a hologram, attached to the package by glue. Such systems may be easily defeated. The disadvantage of such systems, despite their relatively low cost, lies in the ease with which can be removed and substituted by fraud ones.

10 Electronic detection systems' technology, however, is more versatile and it has diverse applications. For example, retail merchants may affix to their merchandise electronically detectable indicator tags in the form of conformable laminated antennas and install tag detection modules at their doors in an effort to deter theft. The indicator tags may be concealed so that a would-be thief would not be able to defeat this system by removing
15 the tags from the merchandise. When the indicator tags are not so concealed, the tags are typically affixed to the merchandise so that they can be removed only by store personnel to thwart efforts to defeat the electronic detection system by removing the tags. The U.S. Patents: No. 4,471,343 to Lemelson, No. 3,967,161 to Lichtblau, No. 4,498,076 to Lichtblau, No. 4,517,563 to Diamant, No. 4,580,041 to Walton,
20 4,724,427 to Carroll, No. 4,857,893 to Carroll, No. 5,027,107 to Matsuno et al., No. 5,241,299 to Appalucci et al. are examples of such electronic detection systems.

The main disadvantage of this type of electronic detection systems for applications similar to the ones suggested in this invention is the limited number of information that can be provided even by incorporating into the tag a large number of passive elements,
25 i.e. antennas tuned at different resonance frequencies. Furthermore, means for protecting the information contained in electronic tags, by inducing permanent damage to integrated memories, packaged on or within non conformable substrates, upon

attempts to reach the interior of transporters have been suggested in U.S. Patent: No. 5,233,505 to Chang et al. Similar devices are also known from the European patent applications No 0142013 and No 0509567. These publications describe devices in which a read/write memory is erased when a deformation of the encapsulation occurs.

5 In the known devices, the deformation is either detected using strain gauges (resistors which change their resistance value when they are stretched) or it induces a high voltage spike, that damages the integrated circuits, from a piezoelectric material incorporated in the encapsulation. The published devices refer to the protection against access to secure information and they have the disadvantage that require the use of

10 rigid encapsulation materials in order to function successfully.

The latter systems are solely designed for the protection of data stored in electronic circuits that are incorporated in rigid structures only and consequently they are not conformable enough to be glued around, for example, the sharp edges of a package.

DESCRIPTION OF PREFERRED EMBODIMENTS

With reference now to the figures where similar elements have been given like numerical designation to facilitate an understanding of the present invention, and with particular reference to FIG. 1, the present invention refers to a conformable intelligent tag which incorporates an electronic circuitry which may be activated by a transmitting and receiving unit. The electronic circuitry consists of two parts: 10 and 20. Part 10 is an interconnection circuit consisting of a thin conducting metal path of copper or aluminium laminated between two appropriate polymer sheets so that the laminated structure is highly conformable. The information carrying means 20 are provided on an integrated circuit carrier 21, as shown in FIG. 3, and they are coupled via the conducting spacers 25 onto the conducting path 10.

FIG. 2 shows a pictorial view of the architecture of the conformable intelligent tag of the present invention. It consists of one polymer layer 30 that carries the conducting path 10 which is electrically connected to the information carrying means 20. Layer 30, carrying the conducting path 10, is laminated with an appropriate adhesive 40 to another polymeric layer 50, in a way that secures both conducting path 10 and the information carrying means 20 between the two aforementioned layers 30 and 50. In the wireless version of communication the conducting metal path 10 may play the role of the necessary antenna.

Such materials for laminated conformable printed circuit boards are commercially available with thickness ranging from several microns to several hundred microns. The conducting path may be a metal foil laminated in a conventional way with layer 30 or a thin metal film evaporated onto layer 30. The required pattern of the conducting path 10 may be induced by well known photo-lithographic techniques.

Various patterns 51 and/or colours may be printed, in a conventional way, on the outside surface of the top layer 50, in order to make the intelligent tags visually detectable.

Part 20 is a rigidised substrate, the so-called "chip carrier", which may be an epoxy type printed circuit board 21, that carries one Application Specific Integrated Circuit (ASIC) 22 as shown in FIG. 3 or in another embodiment all the necessary integrated circuits as Chips-on-Board (COB). The application specific integrated circuit is attached
5 on the chip carrier by commercial adhesive and it is electrically connected to the conducting spacers 25 by wire bonding 23 and through the conducting paths 24. In another embodiment the wire bondings may be substituted by flip-chip techniques. The conducting spacers 25 are extended to the back of the substrate where suitable copper pads 90 are formed like in the case of double-sided printed circuit boards. These pads
10 are coated with a thin film of gold to prevent copper oxidation, when exposed as in the case of FIG. 5, and they are electrically connected to the conducting spacers 25 with plated-through holes drilled through the epoxy substrate of the chip carrier.

To keep the coupling between the electrodes and the destruction means from being tampered with externally, an embodiment of the device according to the invention is
15 characterised, in that at least one of the layers 30 of the conformable laminated structure which carries the conducting paths is laminated with a commercial adhesive 40 to another layer 50 having a relatively lower peeling strength in comparison to the one of adhesive 60 that is used for the gluing of the whole conformable structure on package 70 under protection.

20 The lamination adhesive 40 may also be used to protect from moisture and to isolate electrically electronic circuit 20 from the adjacent part of the conducting path 10. However, the Application Specific Integrated Circuit 22 may have its own protective isolation layer. In that case the damage induced during unauthorised peeling of the intelligent tag may be due to the disruption of conducting path 10 and the possible
25 disruption of joints 80, between the conducting spacers 25 of the chip carrier and the conducting path 10. The joint may be a commercial metal-doped, i.e. silver-doped, self-cured conductive adhesive.

Fig.'s 4 and 5 show the cross sections of the two types of the proposed intelligent conformable tag. FIG. 4 shows the cross section of the intelligent tag that may be interrogated in the contactless manner. A transmitting and receiving unit may be used for the contactless interrogation of an intelligent tag. The circuitry 10 and 20 of the intelligent tag and the transmitting and receiving unit may be a system known in the art, that is able to provide a communication link for information exchange.

In other embodiments radio frequency transmitters, transponders, reprogrammable memory modules and the like may be used with the appropriate receiving equipment in order to establish the contactless exchange of information between the transmitting and receiving unit and the circuitry 10 and 20 of the intelligent tag.

Upon activation, by the RF radiation emitted by the transmitting-receiving unit the electronic circuitry 10, which acts as an antenna, receives the interrogation signals and according to a predefined protocol for information exchange stored in 20, the receiving unit may receive through antenna 10 all the information contained in a EEPROM embedded in the intelligent tag but without any possibility of altering this information. In the case the intelligent tag has been damaged by peeling, detaching or cutting, its circuitry 20 will not be functioning and consequently no answer will be received by the interrogating unit. In the case someone has managed to produce such intelligent tags, an answer is expected to be transmitted by circuitry 20 with the aid of 10 which, however, will not contain the predefined key ID numbers expected.

FIG. 5 shows the cross section of the intelligent tag that may be interrogated by a transmitting and receiving unit that may have the proper configuration of contact pins that will ensure electrical contacts onto the pads 90 provided on the rigid part of the intelligent tape. In this mode of operation the conducting path 10 is connected in series with the integrated circuit 22.

In the case the intelligent tag has been damaged by peeling, detaching or cutting, its circuitry 20 will not be functioning and consequently no answer will be received by the

interrogating unit the pins of which are in direct electrical contact to pads 90 of the intelligent tag. In the case someone has managed to produce such intelligent tags, an answer is expected to be transmitted by circuitry 20 through the aforementioned pads 90, which, however, will not contain the predefined key ID numbers expected.

5 It will be understood that Figures 2,3,4 and 5 show only one embodiment of the architecture. Various other embodiments are possible. For example the conformable part of the circuitry containing the conducting paths may be provided on both sides of the rigid printed circuit board containing the integrated circuits; both sides being glued to the package under protection.

10 While the preferred embodiments of the present invention have been described, it is to be understood that the embodiments described are illustrative only and that the scope of the invention is to be defined solely by the appended claim when accorded a full range of equivalence, many variations and modifications naturally occurring to those skilled in the art from a perusal hereof.

15 FIG. 1 is a pictorial depiction of a conformable intelligent tag of the present invention being applied to a Compact Disk package.

FIG.2 is a pictorial depiction of the architecture of the wiring or antenna part of the conformable intelligent tag of the present invention.

20 FIG. 3 is a pictorial depiction of the right part which carries the Application Specific Integrated Circuit as Chip-on-Board or in another embodiment the integrated circuits which are embedded in the intelligent tag of the present invention.

FIG. 4 is a cross-sectional view of the intelligent tag of the present invention illustrating the circuitry embedded therein in the case of the contactless interrogation.

25 FIG. 5 is a cross-sectional view of the intelligent tag of the present invention, requiring direct electrical contact for the interrogation.

CLAIMS:

1. A system for the preservation of authenticity of various articles comprising : an electronically and visually detectable conformable tag to be glued on their packaging. This tag is characterised from the following:

5 it is extremely conformable so that it can be glued in every kind of surface
(a) it can store in its electronic memory, information about the contents of the packaging it is constructed in such a way that any attempt to remove it, by peeling, detaching or cutting it, results in destruction of its information content

10 (b) detector means for checking the condition of the tag, characterised by the tag being highly conformable and intelligent.
2. A conformable intelligent tag as defined in claim 1, consisting of a conducting metal path of copper or aluminium, in the form of foil or evaporated thin film, electrically connected via conducting spacers (25) to the information carrying means (20) and laminated between two appropriate polymer sheets, so that the laminated structure is highly conformable.

15
3. A conformable intelligent tag as defined in claim 2 where the aforesaid metal conducting is laminated with a commercial adhesive (40) to another layer (50) having a relatively lower peeling strength in comparison to the one of adhesive (60) that is used for the gluing of the whole conformable structure on package (70) under protection

20
4. The conformable intelligent tag as defined in claims 1,2 and 3, wherein said electronic memory means comprises an Application Specific Integrated Circuit or a number of commercially available integrated circuits including a reprogrammable memory module.

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- 5
5. The conformable intelligent tag as defined in claims 1,2,3 and 4, wherein said permanent damage inducing means comprises an intelligent tag incorporating an Application Specific Integrated Circuit connected in series to a conducting path in a way that allows the disruption of the electrical continuity upon peeling or cutting.
6. The conformable intelligent tag as defined in claims 1,2,3,4 and 5, characterised by incorporating an electronic circuit that can be interrogated by a transmitting and receiving unit that detects, in a contactless manner or after the establishment of direct electrical contact.
- 10
7. The conformable intelligent tag as defined in claims 1,2,3,4,5 and 6, characterised by comprising a laminated structure for allowing the permanent damage of the operation of said circuits caused by peeling, detaching or cutting of the intelligent tag.
- 15
8. A system as defined in any of the preceding claims characterised by being used for the distinction between authentic products and their imitations particularly for the speedy investigation of the existence of imitations in shops, warehouses, etc.
- 20
9. A system as defined in any of the preceding claims characterised by being used for the logistics and the automatic receipt or invoice issuing to the purchasers of authentic products in shops, warehouses, etc.
10. A method for sealing packages in order to preserve the authenticity of their contents characterised by the use of a conformable intelligent tag as described in any of the preceding claims.
- 25
11. A method for constructing a conformable intelligent tag as described in any of the preceding claims.

12. A method for interrogating the contents of the electronic memory of the conformable intelligent tag as described in any of the preceding claims, in a contactless manner or after ensuring electrical contact between the pins of the interrogation unit and the appropriate pads of the intelligent tag.
- 5 13. A method for the distinguishing between authentic products and their imitations using a system as described in claim 8.
14. A method for the logistics and the automatic receipt or invoice issuing to the purchasers of authentic products in shops, warehouses, etc., using a system as described in claim 9.

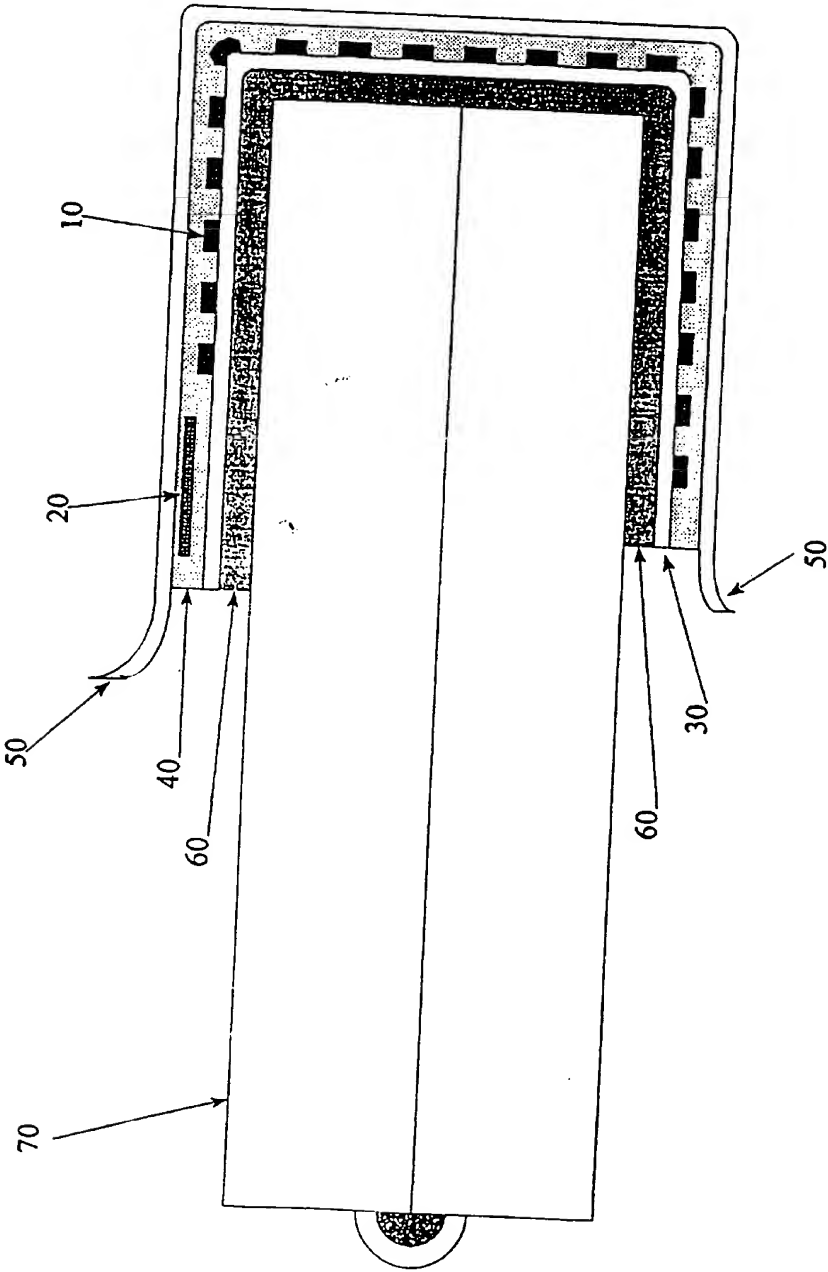


Figure 1

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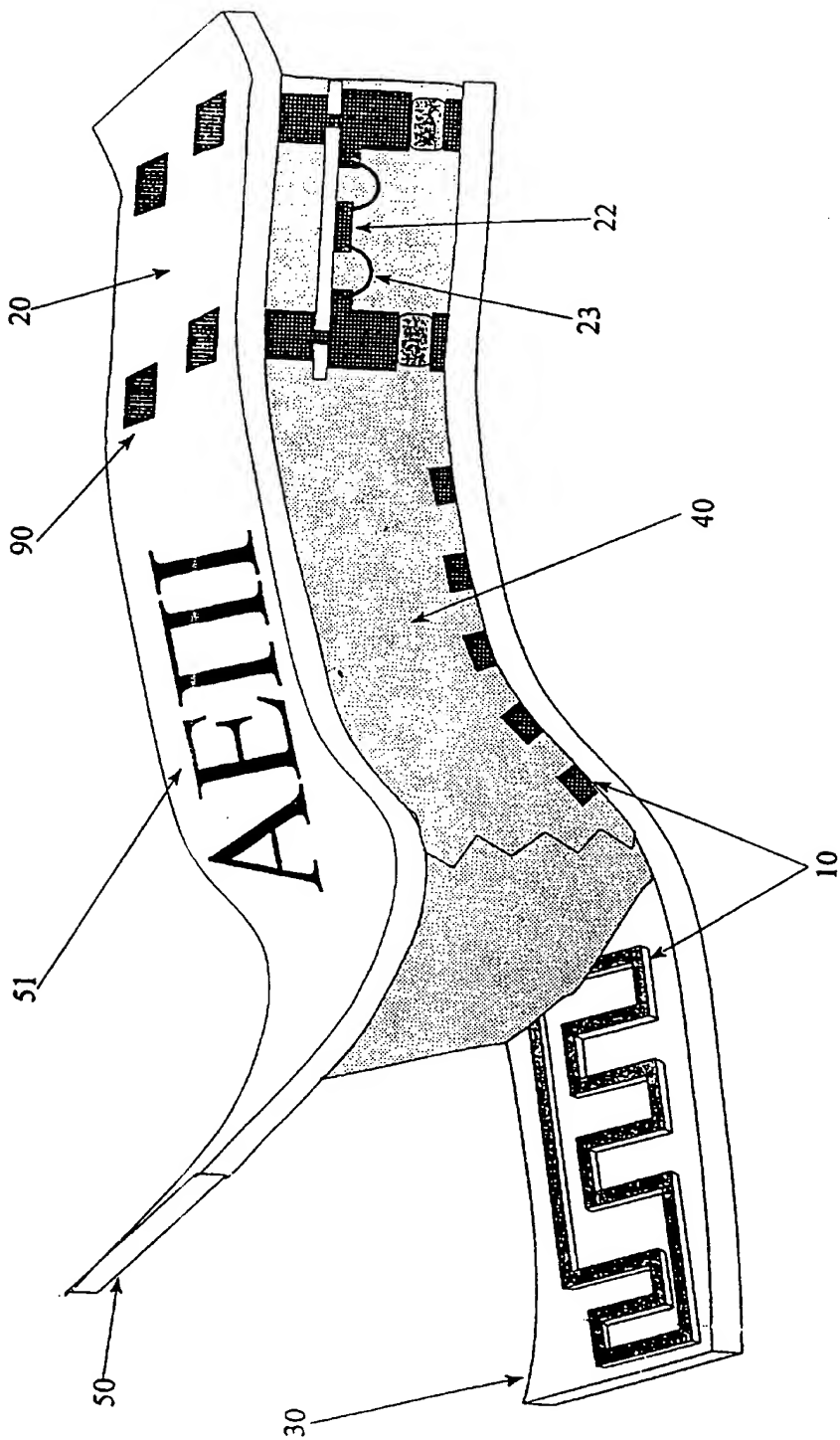
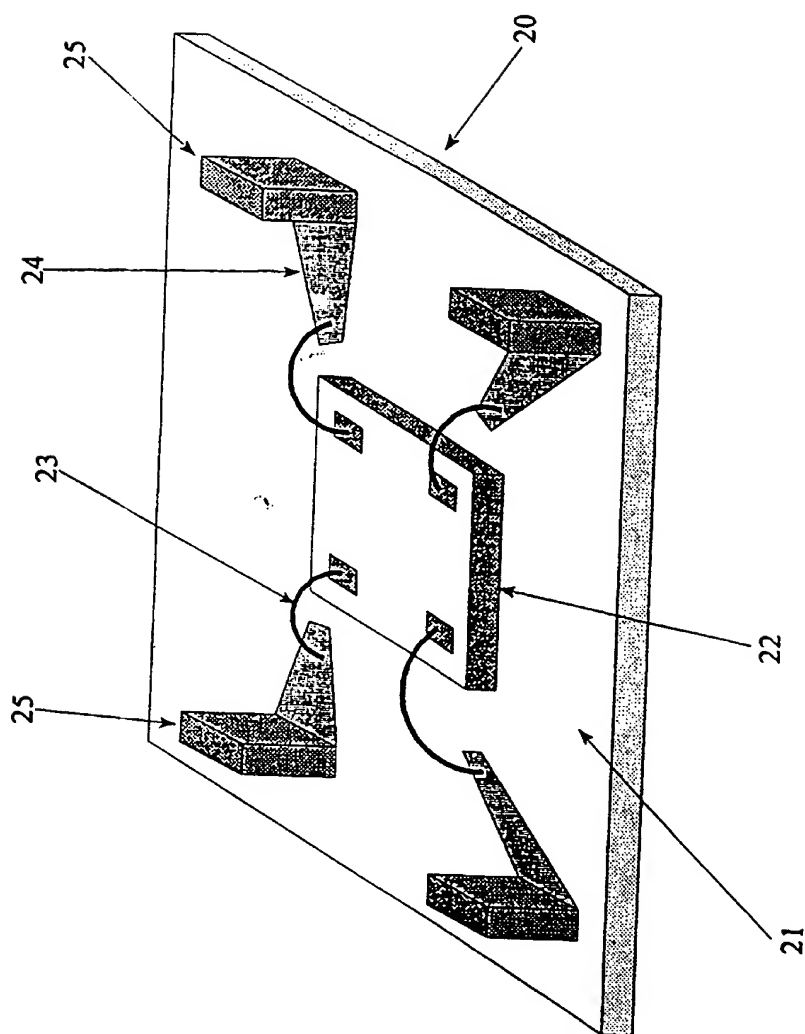


Figure 2

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**Figure 3**

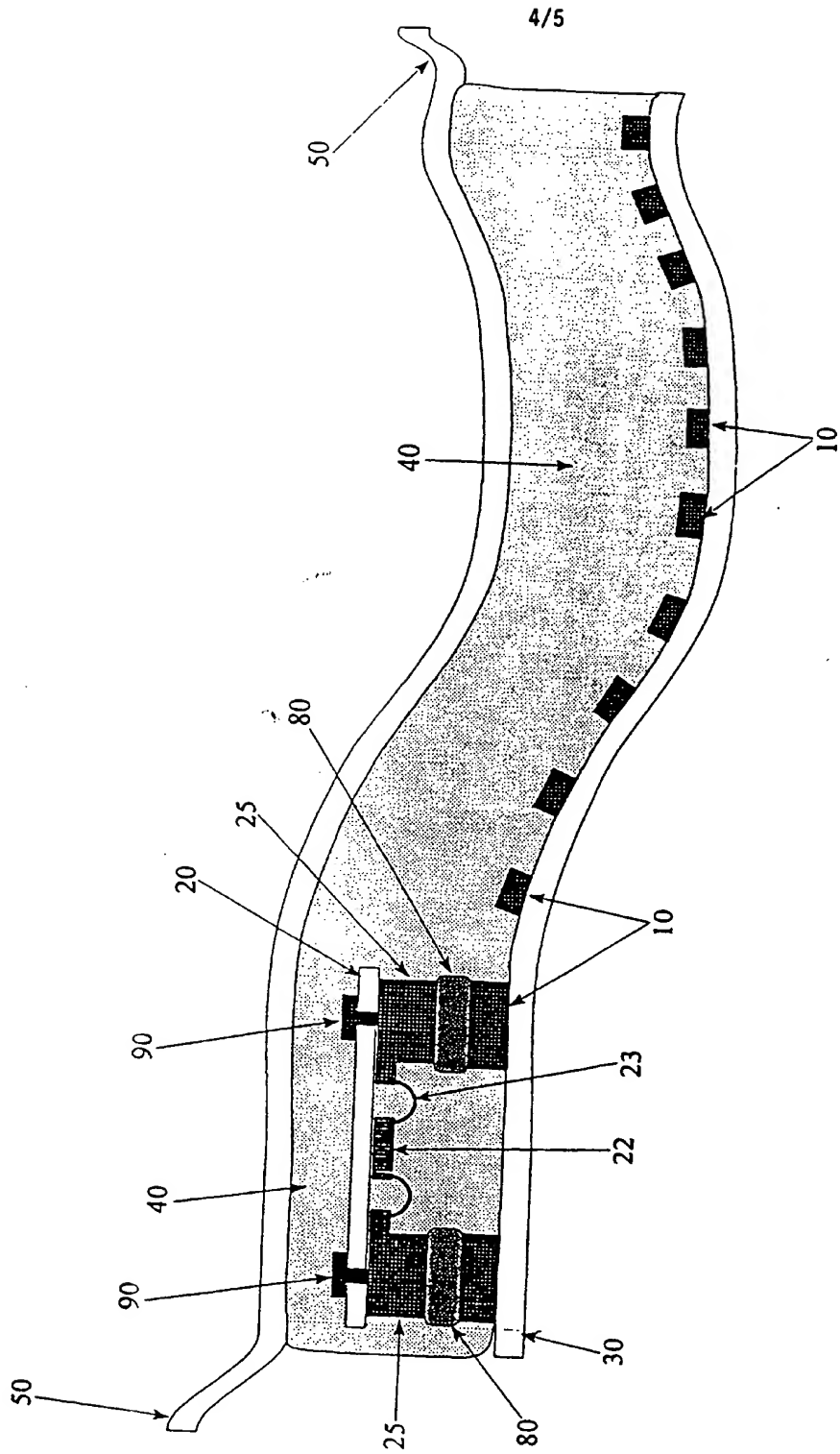


Figure 4

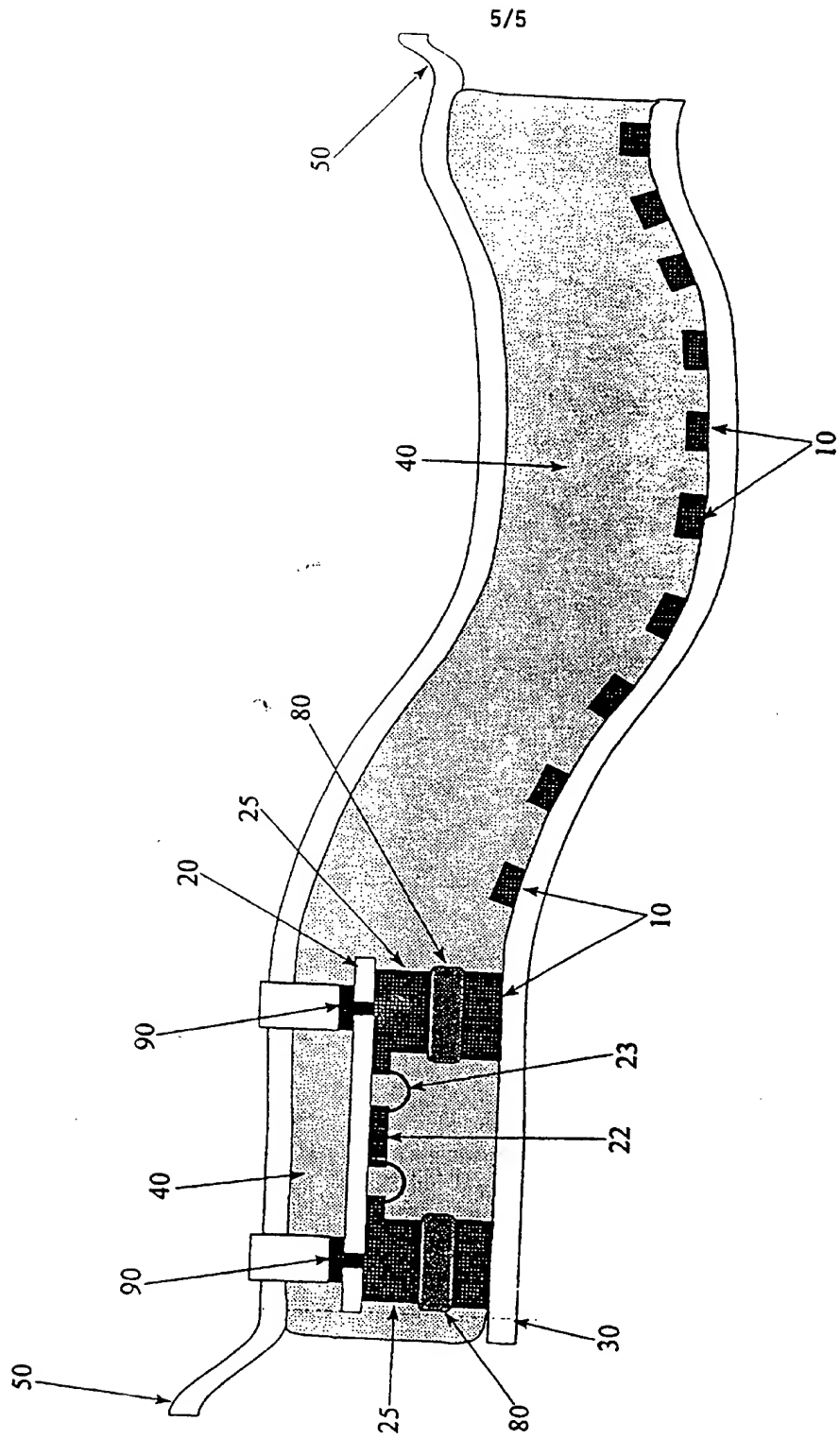


Figure 5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/GR 97/00010

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G06F1/00 G08B13/12 B65D55/02 G08B13/24

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 G06F G08B B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 233 505 A (YENG-MING CHANG) 3 August 1993 cited in the application see abstract; figure 5 ---	1
A	GB 2 270 785 A (GORE & ASSOCIATES) 23 March 1994 see page 13, line 19 - page 16, line 3; figures 1-5 ---	1-14
A	GB 2 257 278 A (ESSELTO METO INT. PROD.) 6 January 1993 see page 2, line 9 - page 5, line 17 ---	1,6,8,9, 12
A	EP 0 637 551 A (TEXAS INSTRUMENTS) 8 February 1995 see abstract see column 4, line 9 - line 26; figure 5 -----	1,5,8,10

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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Date of the actual completion of the international search

25 June 1997

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INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No
PCT/GR 97/00010

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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